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# Establishing a Peach Hedgerow Orchard

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# Foreword

Peach production in the United States exceeds that of all other countries except Italy. The Fruit Outlook and Situation, published by the U. S. Department of Agriculture Economics and Statistics Service, lists the total U.S. peach production in 1985 at 2.148 billion pounds (42.96 million 50-pound bushels) in 1985, and 2.28 billion pounds (45.6 million bushels) in 1986.

The southeastern states account for approximately one-fourth of this production. A renewed interest in commercial peach production in Mississippi began in the early 1980's and a high-density peach orchard was established at the Mississippi Agricultural and Forestry Experiment Station Pontotoc Ridge-Flatwoods Branch.

The current trend toward high density peach orchards (those with more than 100 trees per acre) began in the United States in the early 1960's. In conventional plantings, trees are usually spaced 20 feet apart in rows 20 feet apart (20 x 20 or approximately 100 trees per acre). High density orchards of smaller (dwarfed) trees have two or three times as many trees per acre. Success with high density apple orchards encouraged researchers and commercial peach growers to move to higher density orchards by planting trees closer together and reducing space between rows.

Much of the success with high density apple orchards is due to the availability of dwarfing rootstocks. The lack of suitable dwarfing rootstocks for peaches presented problems in higher density plantings because it proved difficult to control tree vigor and trees would overgrow their allotted space. Success, however, was achieved with the development of intensive management practices.

In this publication, the authors begin by summarizing recommendations for establishing a hedgerow peach orchard in Mississippi. This is followed by a review of early high density fruit production research, which provided the basis for the Mississippi high density peach production, reported in detail beginning on page 7.

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# Establishing a Peach Hedgerow Orchard

## *A Summary of Recommendations for Mississippi*

### *Site Selection*

The location selected should allow cold winter air to freely drain away to avoid trapped cold air that could cause frost and/or freeze damage. Soil type should also be considered in the selection process. A soil with good internal water drainage may avoid tree root problems so trees will be healthy and bear good crops.

### *Soil Preparation*

Test the soil for pH level and mineral content. Make necessary adjustments prior to planting. Adjust the soil pH to 6.5 or slightly higher. Subsoil, preferably to a 24-inch depth, to break any hardpan.

### *Irrigation*

Irrigation is imperative. Install the system, whether it is trickle irrigation or overhead sprinklers, prior to planting and operate immediately after tree planting.

### *Establishment*

Plant in early spring, in soil that is not too moist. Early planting allows the root system to become established before leaf bud break. Roots begin to grow at 50°F soil temperature.

Plant on a slight ridge to reduce the potential of root problems. If lime is needed, it should be added before final soil preparation. The tree row should be marked with a middle buster, then use a subsoil chisel in the bottom of the row to a depth of about 2 feet to allow the new tree roots to penetrate more easily.

Orient tree rows in a north-south direction. Tree spacing depends upon the level of management planned, the training system selected, and the size of equipment to be used. Size of tree blocks should be based on ease of cultural operations and the marketing system. Length of rows should not be excessive.

### *Training System*

Trees in closely spaced training systems demand careful attention to pruning and require more pruning time than those conventionally spaced. A modified-leader fan spaced 12 x 14 feet or a trellis system spaced 10 x 14 feet is suggested.

Spacings between the rows should be at least 14 feet to accommodate a compact tractor, power sprayer, mowing equipment, and narrow trailers to haul the fruit and serve as a picking (and/or pruning) platform. Spacings within the row should be from 6 to 14 feet. More trees result in more early fruit. Early yields are usually correlated with tree numbers per acre. Hedgerow height can vary from 7 to 10 feet and yields often increase with additional tree height. Hedgerow width should ordinarily not exceed 3 feet for the permanent framework. Trees higher than 7 feet will require picking (and pruning) platforms (narrow trailers to fit middles), or ladders.

There are advantages for central leader trees, which may be trellised with a single wire at 6 feet. The trunk can be attached to the wire to prevent wind damage to both young and fruiting trees. Primary and secondary scaffold limbs can be developed to fill the hedgerow space. Another training system sometimes used is a modified central leader with large scaffold limbs being developed to fill hedgerow space with fruiting wood.

Evaluate the training system selected through actual experience before making large plantings. A trial planting of one-half acre is suggested. Keep good management records, including the amount of time spent for each operation. This information will be valuable for future decisions.

### *Fertilization*

Adjust soil nutrients, such as $P_2O_5$ and $K_2O$, to recommended levels before planting, based on soil analyses and technical recommendations. Monitor soil minerals annually by collecting soil samples in late summer. If soil pH is below 6.5, add lime at recommended rates. Collect leaf samples annually in mid-August for tissue tests. Fertilizer needs will be indicated by foliar analysis and recommendations should be followed.

Nitrogen is the element most often needed. Split applications are preferred, particularly during the establishment period. Four monthly applications are suggested beginning one month after planting (April, May, June, and July) for the first two seasons. Irrigate to incorporate the fertilizer. In the third and subsequent seasons, two-thirds of the fertilizer should be applied in early spring (before growth begins) and the other third (after harvest) in late June, July, or early August.

### *Vegetation-free Band*

Do not allow weeds and grass to compete with newly planted trees. A 2-foot weed-free band on either side of the tree row is recommended during the first year. Maintain a weed-free band to or slightly beyond the tree drip-line during succeeding years. Herbicides can be used to maintain the weed-free status. Cultivation cuts feeder roots and may injure the tree trunks.

### *Drive Middles*

Fescue (Kentucky 31) is recommended for the sod middle. The grass selected should provide for traffic wear and should not easily creep into the weed-free band under the tree canopy. Sod is recommended over disking in order to allow cultural operations to be performed even during rainy weather.

### *Pest Control*

An integrated pest management program should be followed. A standard spray schedule can be used as the alternative. Control recommendations can be obtained from the County Agricultural Extension Office.

### *Fruit Thinning*

The amount of fruit to leave on the tree depends on the size and strength of the scaffold structure. Keep in mind that two or three mature peaches will weigh approximately one pound. Generally, 30-40 mature leaves are required to produce a marketable peach, depending on soil water supply and general cultural conditions.

### *Orchard Equipment*

A low, narrow-profile tractor is ideal for hedgerow orchards. Orchard machinery, such as air-blast sprayers and flail chopper-mowers, usually require at least a 50-horsepower tractor to operate efficiently. For large operations, pneumatically operated pruners should be considered along with tree hedging equipment to mow the sides and top of hedges.

### *Marketing*

A marketing program should be planned before the first tree is planted. There are several marketing systems which may be used, each of which has advantages for growers as well as the customer. These include:

**(1)** In "Pick Your Own" orchards, the customers are notified of the ripening periods, cultivars, and general availability (volume).

**(2)** In "Roadside Marketing," the grower picks fruit into consumer sized containers (packages) and has a salesperson wait on customers in a roadside stand.

**(3)** With "Wholesale Marketing," the fruit is packed in wholesale containers and sold to retailers in town or to packing houses for delivery to wholesale markets in distant cities.

# Early High-Density Research

The basic recommendations for establishment and maintenance of high density orchards evolved from nearly two decades of research by many workers in a number of states and in other fruit-growing nations of the world.

A review of highlights of research prior to establishment of the Mississippi high density peach research orchard should help peach growers and research workers gain a better understanding of the establishment and management of orchards planted at densities of more than 100 trees per acre.

### *Preplant Soil Treatments*

A 13-year study was made by Savage, Hayden, and Ward (41) in Georgia with 'Cornet' peach trees in old orchard sites subject to short peach tree life problems. Seventy-one percent of the trees in the pre-plant, subsoiled plots were still living while only 47 percent were living in the non-subsoiled plots. Subsoiling in row middles after planting was not beneficial. If trees were stunted during the first year in the orchard, they were not able to achieve optimum growth in subsequent years. The Georgia scientists also found a higher moisture content at the 12-inch depth during the growing season in the non-subsoiled plots.

Pre-plant recommendations (40, 41) included:

1. Subsoil to a depth of 18-24 inches to shatter compaction pans. Maximum shattering of the subsoil is achieved when the soil is relatively dry.
2. Fumigate soil that previously has grown peach trees, if a need is indicated by nematode assay. The soil temperature should be above 50°F at the 6 to 7-inch depth to achieve satisfactory results.
3. Liming the soil should adjust the pH to 6.5 and soil should have a favorable calcium (Ca) level in the top 12-16 inches for the southeastern United States. This is important because Ca moves only about 1 inch a year when applied to the soil surface and not incorporated.

### *Nursery Tree Sizes*

Planting of nursery trees over 5 feet tall ordinarily is not recommended because tree vigor declines with the increased transplanting shock (5). Norton (36) stated that 1-year whips used in high density systems will require several years to catch up with well-grown, feathered nursery trees. Tall (6 feet) peach nursery trees planted in a hedgerow produced more fruit than short (2 feet tall) trees (1).

### *Tree Spacings*

The planting distance selected for a hedgerow peach orchard should permit the bearing mantle to fill the row (hedge space) quickly, and provide early tree-root competition that would reduce vegetative growth and enhance yields (11).

Hartman and Hill (22) tested 'Redhaven' and 'Redskin' trees spaced 5, 7.5, 10, 15, and 20 feet apart in rows spaced 20 feet apart. Closer spacing resulted in tree competition for water and nutrients. Trunk circumference was less as spacing between trees was less. The closer spaced trees required more dormant pruning. Time required to prune trees spaced at 5 feet was two to three times that for trees with the 20-foot spacing. Yields in the third year were higher in plots with 5-foot spacing than in plots with standard 20-foot spacing.

Leuty and Pree (34) tested 'Cresthaven,' 'Olinda,' and 'Redskin' at three spacings (8 x 12 feet, 8 x 16 feet, and 14 x 20 feet) with three training systems (palmette, hedgerow, and standard open center). Moderately dense hedgerows increased accumulated yield 67 percent over the widest spaced rows during the first few years of the experiment. By the end of the ninth year, standard open center trees had out-yielded those in the other two systems. The most productive trees were the tallest and widest—height exerted the greatest effect on yield.

Chalmers, Mitchell, and van Heek (12) stated that "the growth rate or vigor of the vegetative portion of the top of a plant is directly correlated with the growth rate of the roots. One should be able to suppress the vigor of trees without dwarfing rootstocks if one can manipulate the soil factors that control the growth rate of the roots. When root growth of mature peach trees has been suppressed by age, the unused portion of their photosynthetic productivity is channeled into fruit growth."

Chalmers, Mitchell, and van Heek (12) spaced trees 3.3 feet within rows and 6½ feet or 13 feet between rows. Irrigation along with tree density was used to control root growth. The results of this experiment showed:

1. Higher tree densities result in root competition which affects fruit set and tree growth.
2. Trees pruned heavily in summer were not as productive as lightly pruned trees.
3. Trunk cross-sectional area was not reduced significantly in the closer spacings, but there was a trend in that direction.
4. Trees in the closer spaced plantings were taller than those at wider spacings, therefore light competition caused partial etiolation.
5. Trees irrigated least were the least etiolated.

### *Training Systems*

Childers (14) believed that commercial growers desire a free-standing tree. The alternatives to free-standing trees are those supported by stakes or trellis. A trellis system in 1978 was reported to cost around $1,500 per acre. Cost of the stake system was slightly less. Most growers prefer to avoid expenses of support systems even though they have a number of advantages (7, 37, 38). Large trees can be planted to promoted early bearing, if supported. Trellis systems provide for support during ice storms, during strong winds, in periods of heavy crop loads, and provide a pattern for training the trees.

Childers (14) lists several advantages of smaller trees over standard sizes at maturity. Although his list was developed for apples, the points are valid for peaches if tree size can be controlled. Advantages listed by Childers for smaller trees are: **(1)** reduced pruning costs (50% or less); **(2)** less spray material per unit of fruit weight, and spray coverage is more thorough; **(3)** smaller trees permit use of smaller and less expensive orchard sprayers and other equipment; **(4)** laborers prefer smaller trees; **(5)** fruit quality is usually higher, therefore growers receive increased returns on investment earlier; **(6)** harvesting costs are half those required by picking from ladders; and **(7)** small trees are easier and less expensive to manage in nearly all operations.

Chalmers and van den Ende (11) presented five physiological and management criteria that they consider necessary for optimum yield: **(1)** tree design that fills the allotted space quickly, resulting in optimum land use; **(2)** uniform and controlled distribution of leaves and fruit to improve light interception and photosynthetic efficiency; **(3)** an order for branch and leaf array that diminishes light competition within and between trees to minimize the effects of crowding that usually results from high plant densities (especially with peach trees); **(4)** close planting to create root competition thereby reducing vegetative vigor, while increasing fruitfulness; and **(5)** high tree numbers per acre to provide high yields early in the life of the planting.

The Tatura trellis system (43) was developed with the view that it would meet these criteria. The rows were positioned in a north-south direction for maximum sunlight exposure. Tree spacing was 3.3 x 20 feet. Each tree had two scaffold limbs growing at right angles to the row-middles. Both scaffold limbs were trained at 60° - 70° from the horizontal so that the canopy formed a V-shape. Mature tree height was about 12 feet. The tip of the "V" canopy of one row was about 6½ feet from the tip of the "V" canopy of the next row. Summer pruning regulated canopy depth and shading.

Total yields were 2,700 bushels per acre for five growing seasons compared to 975 bushels per acre from commercial orchards with 122 trees per acre. Van den Ende and Chambers (43) believed that the Tatura trellis system would continue to yield at the maximum annual rate of 1,125 bushels per acre per year. The system did not show signs of over-crowding.

Orchard experiments (4) with high-tensile wire have shown trellises can serve as a management tool, particularly for pick-your-own operations. One acre of trellised orchard may have the same productivity as 2½ to 5 acres of free-standing trees. High-tensile wire, coupled with pressure-treated wood posts, may last 35 years or more and support more than one planting, depending upon the crop grown.

The M.I.A. (Murrumbidgee Irrigation Area, Yanco Research Station, New South Wales, Australia) system (9) uses an inverted "V." Fruit is produced on the outside and the system is readily suited to mechanization. The shape of this system is the reverse of the Tatura trellis. There are two rows of trees, one along each side trained toward the center so that the canopy is pyramid-shaped. This system overcomes the problem of removing interior pruning debris inherent to the interior portion of V-shaped designs.

Early high-density peach research in the United States was conducted by Hayden and Emerson (23) during the late 1960's and early 1970's. Their research used free-standing trees to avoid the costs of support structures. Training systems studied were:

1. High-density vase where scaffolds were tipped during the dormant season to strengthen them. Trees were sheared during the summer to limit tree size.
2. Modified-leader fan with a single central leader and lateral scaffolds extending in-the-row only.
3. Two-scaffold vase fan with both scaffolds developed in each direction in the row.
4. Pillar systems using a central leader with no scaffold branches. Small branches were tipped during the summer and fruited the second year. After fruiting the branches were pruned back nearly to the central leader.
5. Belgian-fence system with trees planted at a 45° angle. Tree tops were inclined in the row and vertical shoots developed from the inclined trunk.
6. Double Belgian-fence with two trees planted in the same hole but inclined in opposite directions in the row.
7. Standard open center trees were used as the control.

Results from this work (18) showed that yields were correlated directly to tree density. There was little effect due to tree training system except in the open center and vase-shaped systems where more severe pruning delayed fruit bud formation, thereby reducing yields in the first and second cropping years. Winter pruning was required for stiffening tree scaffolds to hold crop loads and summer shearing was necessary to contain growth to the allotted space. Harvesting costs for the hedgerow systems were reduced up to 60 percent over systems requiring ladders because the hedgerow systems used a moving wagon as a picking platform, when compared to systems requiring ladders.

Horton (26) designed an orchard for mechanized pruning, spraying, and harvesting without using a trellis. The canopy shape was a "Y" viewed from the end of the row.

New orchard designs should be considered carefully so they will be adaptable to new technology. Ideas to consider are: **(1)** worker preference for smaller trees, **(2)** smaller trees are convenient for pick-your-own operations,

(3) a planar surface is readily adaptable for machine pruning and harvesting, and (4) shallow canopies increase the effectiveness of pesticide applications as well as enhance sunlight penetration and photosynthesis.

### *Summer Pruning*

Hayden and Emerson (24, 25) used summer pruning of peach trees to reduce tree vigor. Summer pruning was more dwarfing than winter pruning and promoted early fruit bud formation. Summer pruning promoted good light penetration, good fruit color, and uniformity of fruit maturity at harvest.

Christ (15) found the best time to prune (mow) peach trees, regardless of cultivar, was late July in New Jersey. Trees should not be mowed from the period 2 weeks before and through harvest to avoid shaking off fruit. Mow in early August if the cultivar ripened in late July. Mowing during these time periods removed the vigorous upright soft growth in the top of the tree, allowing sunlight penetration and enhanced fruiting wood quality.

Marini (35) reported summer pruning (selective cutting as opposed to mechanized shearing) plus winter pruning enhanced winter hardiness of fruit buds and reduced the amount of dormant pruning. This practice resulted in the largest yield and value per acre followed by dormant-pruned trees (no summer pruning); summer-mowed trees had the least yield.

### *Light Penetration*

Several workers have reported that light distribution was adequate in the outside 10-20 inches of canopy but shading was very intense beyond that point (20, 29). They reported that hedging temporarily decreased shading in the fruiting zone, but regrowth caused additional internal shading due to increased leaf density. Dormant pruning was needed to open up the canopy to improve light distribution. The distance between trees in the row depends upon the level of management to be given. Generally, this distance should not exceed 10 to 14 feet. The minimum alley width should be determined by equipment to be used and the desired height of the hedge. The north-south row orientation was recommended for maximum light interception and minimum shading.

Beutel (8) found the lower fruitwood in hedgerow trees was not shaded out more than in conventional open center trees.

### *Mineral Nutrition*

Nitrogen is the major nutrient used to control tree growth and fruiting. Other minerals are supplied mainly to prevent deficiencies (6, 13). Koch (32) stated that "calcium nitrate contains the lowest percentage of N and is the most expensive on a unit of N basis, but it does have some advantages. Soil pH will not be lowered to less than 6.0 and a substantial amount of Ca will be added to the soil with regular use."

Split or multiple applications of N provided for optimum growth. This is particularly important for immature trees. Brittain (10) stated that "in the Southeast, 45-90 pounds of N per acre annually are needed, with at least half as the nitrate form." It is known that "ammonium ions ($NH_4$), if present in the root zone, decrease the uptake of Ca and later interfere with the transport of Ca within the plant," (19). The amount of time required to change ammonium ions into nitrate ions is not resolved.

Trees deficient in Ca usually are not detected by foliar symptoms. Economic losses are associated with physiological disorders in fruit. Therefore, adequate Ca levels should be monitored carefully. A continuous supply of Ca to the roots is necessary along with adequate soil moisture.

Cummings (16) reported that soil pH below 5.6 resulted in poor tree growth, low fruit yield, and small fruit size. Tree longevity was enhanced when pH was maintained above 6.0 in addition to increased annual tree growth and fruit yield.

Childers (14) reported studies that showed that soil pH between 6.5-7.0 was desired in order to increase Ca availability. Jones (27) said yearly applications of lime, based upon soil analysis, were more desirable than large applications every third or fourth year, since the downward movement of lime was a slow process.

Micronutrients most often deficient in orchards are boron (B), iron (Fe), manganese (Mn), and zinc (Zn). Although soil analysis may serve as a guide to fertilization, Kenworthy (30) observed that the best assay of nutrient sufficiency is leaf analysis. Most leaf analyses are interpreted by a normal range. Shear and Faust (42) reviewed leaf-nutrient research results for peaches from throughout the United States and summarized the normal range for several elements. Toxicity ranges were not established.

Normal nutrient element ranges (42), as percentage of leaf dry weight, are: nitrogen (N) 2.5-4.0%; phosphorus (P) 0.14-0.40%; potassium (K) 1.5-2.5%; calcium (Ca) 1.5-2.0%; and magnesium (Mg) 0.25-0.60%. Normal element ranges expressed as parts per million of leaf dry weight are: manganese (Mn) 20-300 ppm; iron (Fe) 100-200 ppm; boron (B) 20-80 ppm; copper (Cu) 6-15 ppm; and zinc (Zn) 12-50 ppm.

### *Irrigation*

Kenworthy (31) reported that 25 percent of the root system supplied with adequate water was sufficient to prevent moisture stress. Peach root growth was not confined to one side of the tree when water was only applied to one side. Peach roots were not made deeper or more shallow by irrigation methods. It was reported that 80 to 90 percent of the feeder roots are in the upper 12 inches of soil.

The edible portion of the peach fruit is approximately 87 percent water. It was estimated that 66 percent of the final fruit volume was attained during the last 30 days of growth. If fruit growth was slowed at any stage during its development, the final swell before ripening would not compensate for this loss. Proper irrigation would increase yields by approximately 25 percent due to increased fruit size (10).

Daniel (17) estimated that a large, mature peach tree requires 24 gallons of water per day. Brittain (10) stated that "water deficiency can reduce photosynthesis 40 percent before the leaves actually show wilting." He stated that 2 inches of water was required every 10 days from pit hardening through final swell, or a total water requirement for mature peach trees of 36 acre inches per year.

Trickle irrigation is an efficient method of applying water. It has been estimated to save 50 percent of actual water needs, with similar savings on energy costs.

## *Pest Control*

Phillips and Weaver (39) reported that insects and mites were not a greater problem in high-density plantings than in conventionally spaced orchards. Hall (21) stated that less spray materials were required in the higher density plantings than in conventional orchards because: **(1)** the distance to adjacent rows was decreased, **(2)** the foliage was closer to the sprayer, **(3)** the rate of loss of air velocity and volume was reduced, **(4)** the efficiency of low-volume sprayers in relation to droplet deposition was enhanced, and **(5)** blow-through-and-wrap-around potentials were enhanced.

**Figure 1. Peach hedgerow orchard at the MAFES Pontotoc Ridge-Flatwoods Branch Experiment Station in September 1981 (second year).**

# Mississippi Peach Research

A peach hedgerow orchard (Figure 1) was established at the Pontotoc Ridge-Flatwoods Branch of MAFES in Pontotoc County, Mississippi, April 10, 1980.

This experiment studied the effect of two tree training systems, initial tree heights, cultivars, fertilizer sources, and fertilizer rates on growth and precocity during the first 3 years.

## Materials and Methods

A $2^4$ factorial experiment was arranged in a split-split plot design (Table 1) with three-tree plots (Figure 2) and four replications (48 trees per replication) for two cultivars. Whole plots were trellis-trained or central-leader trained trees. Sub-plots were four fertilizers (two fertilizer types with two rates each). Sub-plots consisted of two nursery tree heights (16 sub-subplots each per replication). Cultivar treatments were analyzed using a randomized complete block analysis of variance. Mean separation was by Fisher's Protected LSD test.

The soil was an Atwood silt loam (fine-silty, mixed thermic Typic Palevdalfs), well-drained, with moderate permeability and high water-holding capacity (33).

Agricultural limestone (95% $CaCO_3$ equivalent) was broadcast at a rate of 3,000 pounds per acre and incorporated by disking in December 1979 to raise soil pH from 5.9 to 6.5. Soil P and K levels were adjusted to a medium range (70 pounds per acre of P and 240 pounds per acre of K) by adding 350 pounds of superphosphate and 250 pounds of muriate of potash. Nematode assays before and during the experiment indicated that soil fumigation was not needed.

Soil was prepared by using a parabolic subsoiler in two directions to a 16-inch depth and 24-inch spacing. A single middle breaker was used to open the tree-row furrow oriented north-south, and a single subsoil chisel was run down the furrow to a 24-inch depth. Rows then were closed by disking each side of the furrow to form a ridge 12 inches high.

Tree holes (24 inches in diameter, 20 inches deep) were bored 6 x 14 feet apart and trees were planted April 10, one week after forming the ridge. A soil berm was formed around each tree and filled with 3 gallons of water as needed, then leveled with soil when trickle irrigation was installed in May 1980. Trickle emitters supplied 1 gallon of water per tree per hour. Water was applied daily as needed (6 hours per application) May through August 1980-1982. Fifty centibars of soil suction measured at the 6-inch depth were used as the threshold to begin irrigation.

Fertilizers used were: Calcium nitrate—$Ca(NO_3)_2$ (15.5N-OP-OK), Sta-Green Super Nursery Mix (20N-2.6 P-4.4K) and seven micronutrients: (0.02% B, 0.05% Cu, 2.0% Fe, 0.05% Mn, 0.0005% Mo, 2.0% S and 0.05% Zn) produced by Sta-Green Plant Food Company (Sylacauga, AL).

Fertilizers were applied May 11 and 31, June 11, July 19 and 29, and August 5 and 16 in 1980 using a low rate of 4.2 ounces and a high rate of 8.5 ounces of elemental N per tree for both fertilizer types at each date. The low and high rates in 1981 were 8.5 ounces, and 17 ounces on June 1 and 15, July 14, and

**Figure 2. Trellis-trained trees showing a three-tree plot in March 1982, after two growing seasons.**

August 1. The low and high rates in 1982 were 12.7 ounces and 25.4 ounces on April 9, May 21, June 26, and July 17. Applications were broadcast around each tree in a 12-inch band beginning 12 inches from the trunk. In 1981 and 1982, a 12-inch band of fertilizer was incorporated on both sides of the tree row, beginning 12 inches from the tree trunk.

An 18-inch wide weed-free band on each side of the tree row was maintained with paraquat. Natural sod developed between the rows. Standard pesticide sprays were applied as needed throughout the experiment.

Two initial nursery tree heights—2 feet (short) and 6 feet (tall)—were used for 'Harbelle' and 'Canadian Harmony' on 'Lovell' rootstock. Trees were topped to the desired height at planting. Side branches were cut off at the trunk if branches did not have the desired angle and location when trees were planted. Trunk diameters, measured 20 inches above the ground, were similar at planting for short trees (0.20 inch for 'Harbelle' and 0.20 inch for 'Canadian Harmony'), whereas trunk diameters for tall trees were 0.5-inch for 'Harbelle' and 1.1 inches for 'Canadian Harmony.'

Trees were trained as a central leader with major scaffolds spaced about 8 inches vertically around the central leader, or as a horizontal palmette trellis-trained with three wires 2 feet apart. Side shoots arising from each scaffold were headed back by hand pruning to encourage branching when they were about 8 inches long. The hedgerows were topped by hand in August when tree growth reached 7 feet high in the first season and in July and August when growth reached 8 feet in the second and third seasons. Hedgerows at maturity were pruned to 40 inches wide, 16 inches above the soil, and tapered to 30 inches wide at the top.

In 1980, central leader tree trunks were tied to 5-foot stakes to keep the leaders vertical. Stakes were removed in 1982. Tree diameters were calipered

**Table 1. Design of peach hedgerow experimental orchard at MAFES Pontotoc Ridge-Flatwoods Branch Experiment Station.[1]**

| Tree No. | Tree Rows A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B |
| 2 | B | FCC | FC | FSS | FS | FSS | FCC | FS | FC | FSS | FS | FC | FCC | FC | FS | FCC | FSS | B |
| 3 | B | S | S | T | S | T | T | S | T | T | S | S | S | T | T | T | S | B |
| 4 | B | HB | HM | HM | HM | HB | HM | HB | HM | HB | HB | HM | HB | HB | HM | HB | HM | B |
| 5 | B | FCC | FC | FSS | FS | FSS | FCC | FS | FC | FSS | FS | FC | FCC | FC | FS | FCC | FSS | B |
| 6 | B | T | S | S | T | T | T | T | S | T | S | T | T | S | S | T | S | B |
| 7 | B | HB | HB | HM | HB | HM | HB | HB | HB | HM | HM | HB | HM | HB | HB | HM | HB | B |
| 8 | B | FCC | FC | FSS | FS | FSS | FCC | FS | FC | FSS | FS | FC | FCC | FC | FS | FCC | FSS | B |
| 9 | B | T | T | S | T | S | S | S | T | S | T | T | T | S | T | S | T | B |
| 10 | B | HM | HB | HB | HM | HM | HB | HM | HB | HM | HB | HM | HB | HM | HB | HB | HM | B |
| 11 | B | FCC | FC | FSS | FS | FSS | FCC | FS | FC | FSS | FS | FC | FCC | FC | FS | FCC | FSS | B |
| 12 | B | S | T | T | S | S | S | T | S | S | T | S | S | T | S | S | T | B |
| 13 | B | HM | HM | HB | HB | HB | HM | HM | HM | HB | HM | HB | HM | HM | HM | HM | HB | B |
| 14 | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B |
| 15 | B | FS | FC | FCC | FSS | FC | FSS | FS | FCC | FC | FSS | FCC | FS | FSS | FC | FS | FCC | B |
| 16 | B | S | T | S | T | T | S | T | T | S | S | T | S | T | S | S | T | B |
| 17 | B | HB | HB | HB | HB | HM | HM | HB | HM | HB | HB | HB | HM | HM | HM | HB | HM | B |
| 18 | B | FS | FC | FCC | FSS | FC | FSS | FS | FCC | FC | FSS | FCC | FS | FSS | FC | FS | FCC | B |
| 19 | B | S | T | T | S | S | T | S | S | T | S | S | T | S | T | S | T | B |
| 20 | B | HM | HM | HM | HB | HM | HM | HM | HB | HM | HM | HM | HM | HM | HB | HM | HB | B |
| 21 | B | FS | FC | FCC | FSS | FC | FSS | FS | FCC | FC | FSS | FCC | FS | FSS | FC | FS | FCC | B |
| 22 | B | T | S | T | S | S | T | S | S | T | T | T | S | T | T | T | S | B |
| 23 | B | HM | HB | HB | HM | HB | HB | HB | HM | HB | HM | HM | HB | HB | HM | HM | HM | B |
| 24 | B | FS | FC | FCC | FSS | FC | FSS | FS | FCC | FC | FSS | FCC | FS | FSS | FC | FS | FCC | B |
| 25 | B | T | S | S | T | T | S | T | T | S | T | S | T | S | S | T | S | B |
| 26 | B | HB | HM | HM | HM | HB | HB | HM | HB | HM | HB | HB | HB | HB | HB | HB | HB | B |
| 27 | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B |

[1] Whole plots are defined on the plat by the rectangles with each consisting of four rows. Sub-subplots consisted of three trees per plot within a row as designated by the grouping of the tree number column. Tree number represents one tree.

[2] FC or FCC = Single or double rate of calcium nitrate. FS or FSS = Single or double rate of Sta-Green. S or T = Short or tall nursery tree. HB or HM = Harbelle or Canadian Harmony Peach. B = Border tree. Trees were spaced 6 feet in rows which were 14 feet apart.

**Table 2. The influence of treatments on trunk diameter at 20 inches above soil for two cultivars at the end of each growing season for the years 1980, 1981, and 1982.**

| Treatments | | | | Trunk diameter (inches) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Harbelle | | | | Canadian Harmony | | | |
| Training | Tree size[1] | Fertilizer | Rate[2] | 1980[3] | 1980 | 1981 | 1982 | 1980[3] | 1980 | 1981 | 1982 |
| Trellis | Short | $Ca(NO_3)_2$ | Low | 0.21 | 0.79 | 1.65 | 2.07 | 0.18 | 0.80 | 1.71 | 2.19 |
| | | | High | 0.21 | 0.72 | 1.71 | 2.15 | 0.20 | 0.82 | 1.60 | 2.28 |
| | | Sta-Green | Low | 0.20 | 0.71 | 1.65 | 2.01 | 0.23 | 0.71 | 1.51 | 1.98 |
| | | | High | 0.19 | 0.78 | 1.69 | 2.12 | 0.22 | 0.81 | 1.80 | 2.26 |
| | Tall | $Ca(NO_3)_2$ | Low | 0.62 | 1.04 | 1.79 | 1.97 | 0.78 | 1.13 | 1.89 | 2.25 |
| | | | High | 0.67 | 1.12 | 1.77 | 2.23 | 0.76 | 1.14 | 1.84 | 2.28 |
| | | Sta-Green | Low | 0.65 | 1.04 | 1.82 | 1.95 | 0.81 | 1.15 | 1.77 | 2.14 |
| | | | High | 0.64 | 1.08 | 1.87 | 2.18 | 0.76 | 1.13 | 1.74 | 2.10 |
| Central-leader | Short | $Ca(NO_3)_2$ | Low | 0.21 | 0.73 | 1.61 | 2.12 | 0.19 | 0.75 | 1.66 | 2.34 |
| | | | High | 0.19 | 0.74 | 1.60 | 2.34 | 0.19 | 0.73 | 1.68 | 2.43 |
| | | Sta-Green | Low | 0.21 | 0.69 | 1.57 | 2.07 | 0.19 | 0.74 | 1.56 | 2.18 |
| | | | High | 0.21 | 0.74 | 1.69 | 2.35 | 0.18 | 0.74 | 1.65 | 2.26 |
| | Tall | $Ca(NO_3)_2$ | Low | 0.66 | 1.02 | 1.91 | 2.32 | 0.78 | 1.17 | 1.91 | 2.39 |
| | | | High | 0.66 | 1.11 | 1.93 | 2.37 | 0.80 | 1.17 | 2.00 | 2.32 |
| | | Sta-Green | Low | 0.65 | 1.03 | 1.65 | 2.11 | 0.77 | 1.10 | 1.72 | 2.12 |
| | | | High | 0.73 | 1.15 | 1.93 | 2.31 | 0.81 | 1.17 | 1.93 | 2.32 |
| LSD 0.05 | | | | 0.08 | 0.13 | 0.22 | 0.21 | 0.08 | 0.12 | 0.21 | 0.23 |

[1] Initial tree size at planting was 2 feet (short) and 6 feet (tall).

[2] The low rate of elemental N was 0.42 ounce per tree per application in 1980, 0.84 ounce in 1981, and 1.26 ounces in 1982. The high rate of elemental N was 0.84 ounce per tree per application in 1980, 1.68 ounces in 1981, and 2.52 ounces in 1982.

[3] Initial tree diameter at planting.

20 inches above the soil at the end of each growing season.

Soil samples from the surface to 6-inch depth were analyzed yearly for nutrients beginning in 1980. Thirty-six mature leaves per sample were collected during late August from the middle of mid-level shoots of the center tree of each plot and analyzed for nutrient concentration in the Mississippi Cooperative Extension Service Soil Testing and Plant Analysis Laboratory using emission spectrographic analysis. Samples were prepared by the wet ashing method (28).

## Results and Discussion

### *Tree Sizes*

Trunk diameter differences between tree heights remained throughout the first growing season (Table 2). The appearance of trellis- and central-leader trees during the first year in the orchard is shown in Figure 3. Typical trellis- and central leader-trained trees after 2 years in the orchard are shown in Figure 4. The tall trees still had more bearing surface than the short trees. Visually, the distinction between the amount of bearing surface for central leader short and tall trees were not as great. Small trees were equal to tall trees in trunk diameter after three seasons.

### *Soil Analyses*

The soil pH was adjusted from 5.9 to a level of 6.5 before trees were planted. The pH after 3 years was 6.6 for calcium nitrate plots and 6.0 for Sta-Green plots (Table 3). The addition of Ca from $Ca(NO_3)_2$ maintained the pH. Sta-Green did not contain Ca, thus the

**Table 3. The effect of source and rate of fertilizer on soil pH, P, K, and Mg at the 0 to 6-inch depth, 2-year averages of 'Harbelle' and 'Canadian Harmony.'**

| | | Soil content (lb/A) | | | | Soil content (lb/A) | | |
|---|---|---|---|---|---|---|---|---|
| | | 1980 | | | | 1982 | | |
| Treatments | pH | P | K | Mg | pH | P | K | Mg |
| FERTILIZER | | | | | | | | |
| $Ca(NO_3)_2$ | 6.1*[1] | 68.1 | 258.4 | 150.9 | 6.6* | 37.7 | 160.0 | 63.1 |
| Sta-Green | 5.6 | 141.5* | 449.5* | 149.2 | 6.0 | 111.1* | 372.9* | 135.7* |
| RATE[2] | | | | | | | | |
| Low | 5.9 | 83.4 | 344.7 | 157.6 | 6.3 | 58.9 | 249.2 | 95.1 |
| High | 5.8 | 126.2* | 363.2 | 142.4 | 6.2 | 89.8 | 283.7 | 103.8 |

[1] Differences between fertilizers or rates within a year are significant at $\alpha = 0.05$.

[2] The low rate of elemental N was 0.42 ounce per tree per application in 1980 and 1.26 ounces in 1982. The high rate of elemental N was 0.84 ounce per tree per application in 1980 and 2.52 ounces in 1982.

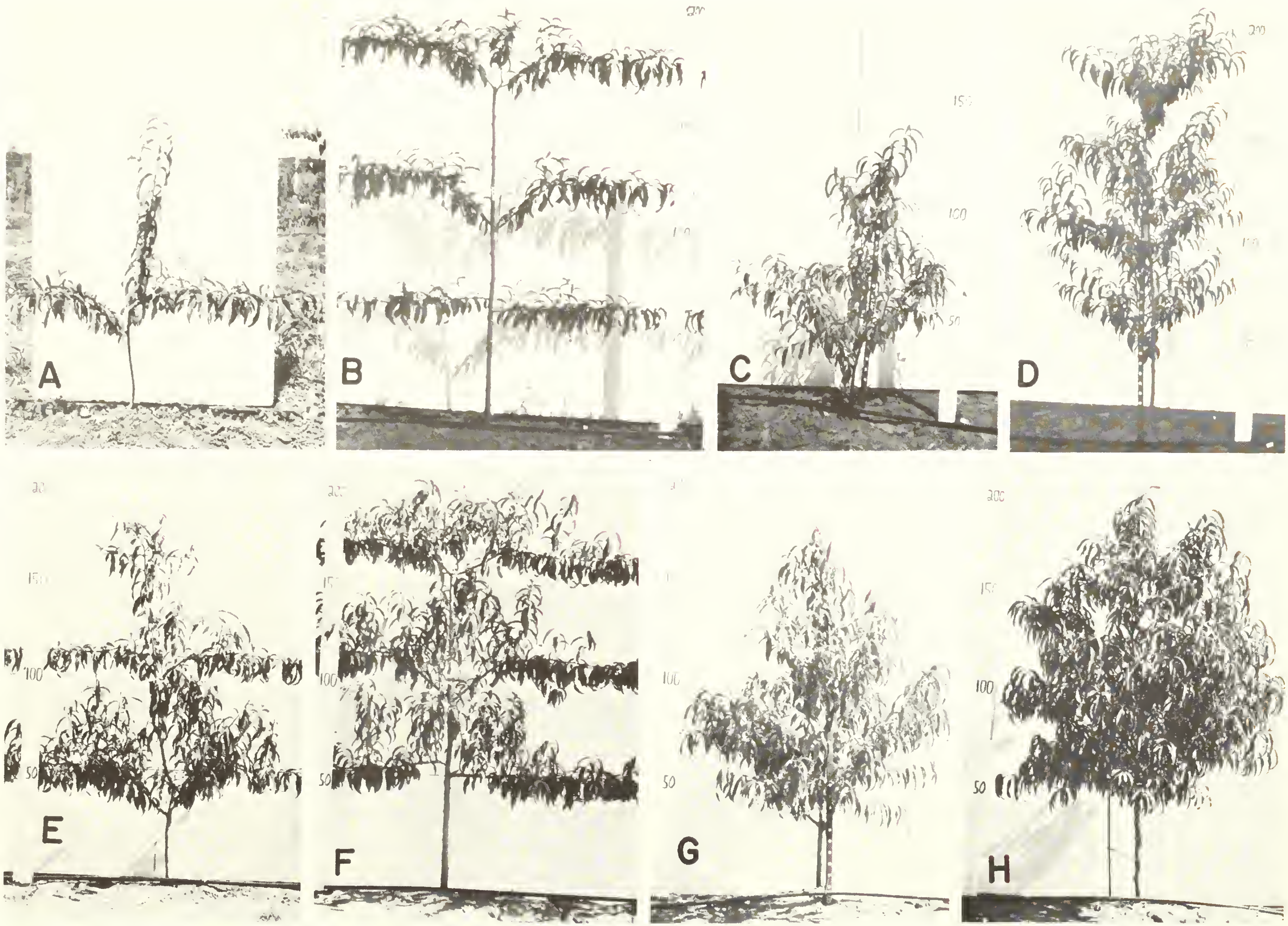


Figure 3. Typical tree systems in July 1980 (A-D) and October 1980 (E-H) of the first growing season. Trellis-trained trees: A and E short (2 feet); B and F tall (6 feet). Central leader-trained trees: C and G short (2 feet); D and H tall (6 feet). Scale is in centimeters.

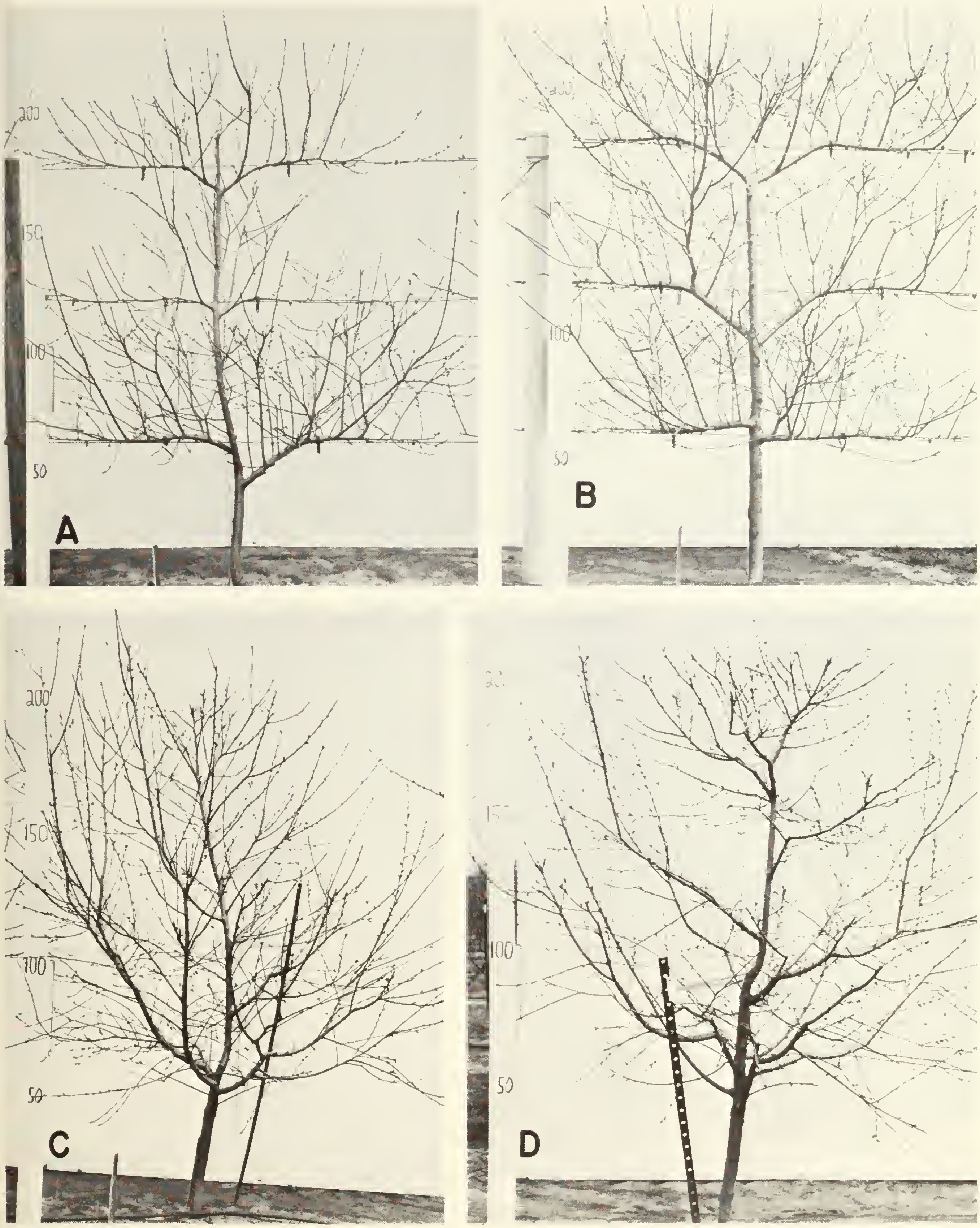


**Figure 4. Dormant peach trees in March 1982, after 2 years in the orchard. Trellis-trained trees: A, short, and B, tall. Central leader-trained trees: C, short, and D, tall. Scale is in centimeters.**

**Table 4. The effect of source and rate of fertilizer interactions on nitrogen in leaves of two peach cultivars for 3 years.**

| Treatments | | Leaf N (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Harbelle | | | Canadian Harmony | | |
| Fertilizer | Rate[1] | 1980 | 1981 | 1982 | 1980 | 1981 | 1982 |
| $Ca(NO_3)_2$ | Low | 3.83 | 2.60 | 3.44 | 3.96 | 2.87 | 3.50 |
| | High | 3.83 | 2.97 | 3.66 | 3.94 | 2.95 | 3.40 |
| Sta-Green | Low | 3.86 | 2.63 | 3.09 | 3.83 | 2.52 | 3.02 |
| | High | 3.57 | 2.81 | 3.38 | 3.97 | 2.80 | 3.32 |
| LSD 0.05 | | NS | NS | NS | NS | 0.19 | 0.25 |

[1] The low rate of elemental N was 0.42 ounce per tree per application in 1980, 0.84 ounce in 1981 and 1.26 ounces in 1982. The high rate of elemental N was 0.84 ounce per tree per application in 1980, 1.68 ounces in 1981, and 2.52 ounces in 1982.

soil pH dropped. Fertilizer rates did not affect soil pH. Sta-Green increased P and K levels in 1980 and in 1982.

### *Leaf Analyses*

Trees receiving calcium nitrate generally had a slightly higher leaf N level than trees treated with Sta-Green; however, differences were not significant (Table 4). Both fertilizers kept the leaf N within the normal range (42).

Leaf levels of P, K, and Ca (Table 5) were kept within the normal range by both fertilizers (42). Trees treated with Sta-Green showed a trend toward increased leaf K, and calcium nitrate-treated trees showed a trend toward increased leaf Ca.

Magnesium concentrations (Table 5) were within the normal range (42). Calcium nitrate-treated trees showed some increase in leaf Mg levels. Neither fertilizer contained Mg; however, after Sta-Green application, the soil pH was reduced to 6.0, which may have reduced Mg availability. The increased K levels in the soil receiving Sta-Green may have restricted Mg uptake. These factors could account for the reduced percentage Mg in the leaves of trees that received Sta-Green.

Micronutrient leaf concentrations (Table 5) were within the normal range (42). Soil applied Sta-Green increased leaf concentrations for B and Mn during the establishment year for 'Harbelle' but not for 'Canadian Harmony.' Sta-Green applications during the second and third years increased leaf B and Mn for both cultivars.

Calcium nitrate trees had increased leaf Fe concentrations in 1981. Sta-Green provided additional Fe, but Mn from the Sta-Green may have interfered with Fe absorption.

### *Fruit Production*

'Canadian Harmony' produced more fruit on tall trees than on short trees in 1981 (Table 6). This difference did not occur in 1982. A similar trend was observed for 'Harbelle.' Initial tree sizes, as measured by trunk diameter, were smaller for tall trees of 'Harbelle' than for tall trees of 'Canadian Harmony' (Table 2). Training systems did not affect yields.

The high rate of calcium nitrate on tall 'Harbelle' trees produced more fruit in 1981 than did other treatment combinations for 'Harbelle' (Table 6). The low rate of Sta-Green in 1982 was not as effective as the high rate for fruit production. The low rate of calcium nitrate in 1982 was as effective as the high rate for fruit production (Table 6).

'Harbelle' was not thinned adequately, resulting in a low marketable fruit yield. Training systems, initial tree height, fertilizer types, or fertilizer rates did not affect marketable fruit yield.

**Table 5. Effect of fertilizer on P, K, Ca, Mg, B, Fe, and Mn concentrations in leaves of two peach cultivars for 3 years.**

| | | Concentration (% dry wt) | | | | Concentration (ppm dry wt) | | |
|---|---|---|---|---|---|---|---|---|
| Year | Treatments | P | K | Ca | Mg | B | Fe | Mn |
| HARBELLE | | | | | | | | |
| 1980 | $Ca(NO_3)_2$ | 0.19 | 1.91 | 1.23 | 0.37 | 19.6 | 76.5 | 57.9 |
| | Sta-Green | 0.21*[1] | 1.98 | 1.21 | 0.39 | 22.0* | 79.9 | 65.3* |
| 1981 | $Ca(NO_3)_2$ | 0.18 | 2.50 | 2.24* | 0.69 | 28.4 | 121.1* | 129.1 |
| | Sta-Green | 0.18 | 2.64 | 2.13 | 0.63 | 31.3* | 106.7 | 192.1* |
| 1982 | $Ca(NO_3)_2$ | 0.15 | 2.23 | 2.05* | 0.57* | 22.3 | 98.4 | 111.3 |
| | Sta-Green | 0.17* | 2.72* | 1.83 | 0.51 | 26.4* | 97.7 | 180.4* |
| CANADIAN HARMONY | | | | | | | | |
| 1980 | $Ca(NO_3)_2$ | 0.31 | 1.90 | 1.26 | 0.38 | 21.3 | 83.2 | 65.6 |
| | Sta-Green | 0.20 | 1.95 | 1.26 | 0.38 | 21.0 | 83.5 | 68.0 |
| 1981 | $Ca(NO_3)_2$ | 0.17 | 2.30 | 2.18 | 0.70* | 28.3 | 131.3* | 144.6 |
| | Sta-Green | 0.18 | 2.49* | 2.16 | 0.63 | 32.5* | 113.4 | 205.1* |
| 1982 | $Ca(NO_3)_2$ | 0.15 | 2.16 | 2.15* | 0.57* | 23.4 | 105.8 | 126.4 |
| | Sta-Green | 0.16 | 2.57* | 1.84 | 0.48 | 25.5* | 106.7 | 188.9* |

[1]Differences between fertilizers within a cultivar, element, and year are significant at $\alpha = 0.05$.

The percent of red skin and percent of soluble solids were not affected by training systems or by fertilizer types or rates (data not reported).

## Summary and Conclusions

Tree training systems were not affected by the type of fertilizer or rates of N selected. Short trees were as large as tall trees after 3 years as measured by trunk diameter.

Tall trees grew adequately in the first year to produce more fruit in the second year than did short trees. Central leader, tall trees of 'Canadian Harmony' with the high rate of calcium nitrate had the highest yields at 12 pounds per tree or 130 bushels (48 lb/bu) per acre in 1981, the second year in the orchard. The poorest yielding combination for 'Canadian Harmony' in 1981 was trellis-trained short trees with the low rate of Sta-Green, producing only 1 pound per tree or 11 bushels per acre. This yield difference between tall and short trees in the second year was not observed in the third year, except in those plots receiving the low rate of Sta-Green.

The highest yield in 1982, the third year in the orchard, was achieved by 'Canadian Harmony' trellis-trained, tall trees with the high rate of calcium nitrate at 65 pounds per tree or 702 bushels per acre.

Calcium nitrate maintained a soil pH of 6.6 but Sta-Green lowered pH to 6.0. Sta-Green increased soil P and K levels.

Calcium nitrate increased N and Ca concentrations in the leaves. Sta-Green increased levels of P, K, B, and Mn in the leaves.

Our recommendation is to plant tall trees and use the high rate of calcium nitrate on acid soils during the first 2 years in the orchard to accent precocity.

## Conventional Trees Compared

Four trees of two cultivars ('Harbelle' and 'Canadian Harmony') were trained to an open center in an adjacent row to serve as an observational check for a conventional open center orchard (Figure 5). These were planted at Pontotoc April 10, 1980. The trees were spaced 20 x 22 feet (99 trees per acre). Trees were fertilized with ammonium nitrate at the high rate per tree used in the hedgerow experiment.

The 1982 total yields from conventional open center-trained trees of 'Harbelle' and 'Canadian Harmony' were 54 and 101 pounds per tree or 5,331 and 10,015 pounds per acre, respectively. 'Harbelle' thus yielded 111 bushels per acre; ' Canadian Harmony' 209 bushels per acre.

Open center trees of 'Harbelle' did not begin fruiting until 1982. 'Canadian Harmony' open center-trained trees had four peach fruits on one tree in 1981. Closer tree spacing of the hedgerow orchard may have increased root competition, resulting in a change to the reproductive phase earlier during the first summer the trees were in the orchard than it did for conventionally spaced trees.

The value of production based on

**Table 6. The influence of treatments on total fruit yield of two peach cultivars for 2 years and on marketable yield in 1982. There were 518 trees per acre.**

| Treatments | | | | Fruit yield (lb/tree) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Harbelle | | | Canadian Harmony | | |
| Training | Tree size[1] | Fertilizer | Rate[2] | 1981 | 1982 | 1982[3] | 1981 | 1982 | 1982[3] |
| Trellis | Short | $Ca(NO_3)_2$ | Low | 0.99 | 52.78 | 26.57 | 1.30 | 51.96 | 46.21 |
| | | | High | 0.13 | 44.62 | 31.70 | 1.57 | 58.11 | 58.47 |
| | | Sta-Green | Low | 0.26 | 43.70 | 32.69 | 0.88 | 43.98 | 41.78 |
| | | | High | 1.06 | 50.46 | 27.38 | 1.28 | 55.71 | 55.31 |
| | Tall | $Ca(NO_3)_2$ | Low | 1.85 | 54.56 | 37.10 | 7.32 | 63.49 | 53.75 |
| | | | High | 5.49 | 64.11 | 28.73 | 7.85 | 64.53 | 56.22 |
| | | Sta-Green | Low | 1.74 | 51.43 | 33.69 | 5.95 | 52.76 | 51.90 |
| | | | High | 1.37 | 52.54 | 32.17 | 10.12 | 59.24 | 50.31 |
| Central-leader | Short | $Ca(NO_3)_2$ | Low | 0.04 | 44.09 | 28.92 | 1.28 | 58.49 | 49.12 |
| | | | High | 0.46 | 54.32 | 25.11 | 1.37 | 54.90 | 54.04 |
| | | Sta-Green | Low | 0.07 | 39.64 | 29.76 | 1.46 | 46.58 | 38.49 |
| | | | High | 0.40 | 51.65 | 36.44 | 1.63 | 53.88 | 50.40 |
| | Tall | $Ca(NO_3)_2$ | Low | 2.34 | 57.81 | 39.79 | 8.97 | 59.30 | 54.92 |
| | | | High | 4.83 | 58.91 | 19.22 | 11.88 | 60.08 | 49.36 |
| | | Sta-Green | Low | 3.20 | 49.01 | 36.27 | 11.35 | 50.77 | 44.71 |
| | | | High | 2.43 | 59.11 | 32.50 | 6.13 | 59.83 | 52.40 |
| LSD 0.05 | | | | 2.54 | 9.11 | 12.79 | 2.89 | 8.31 | 11.97 |

[1] Initial tree size at planting was 2 feet (short) and 6 feet (tall).

[2] The low rate of elemental N was 0.84 ounce per tree per application in 1981 and 1.26 ounces in 1982. The high rate of elemental N was 1.68 ounces per tree per application in 1981 and 2.52 ounces in 1982.

[3] Marketable fruit graded 2-inch diameter and above.


**Figure 5. Hedgerow-trained trees (A-left) of 'Harbelle' and 'Canadian Harmony' spaced 6 x 14 feet, and open center-trained trees (B-right) of both cultivars spaced 20 x 22 feet, July 1982 (third growing season).**


**Figure 6. 'Bicentennial' fan-palmette trellis-trained tree, March 1982.**

wholesale prices at South Carolina shipping points for 2-inch diameter or larger peaches per 38-pound box harvested on June 22 was $7.00 and on July 10 was $5.00 in 1981 (2); in 1982, June 21 value was $10.00 and July 9 value was $7.00 (3).

Based on these prices, the total value of production for open center-trained trees of 'Canadian Harmony' was $1,845 per acre for 10,015 pounds of peaches in 1982. The best hedgerow treatment combination in 1982 for 'Canadian Harmony' was $6,200 per acre for 33,670 pounds of peaches from trellis-trained tall trees using the high rate of calcium nitrate. Returns for the same treatment combination with 'Harbelle' was $8,730 per acre for 32,208 pounds. Price differences for 'Harbelle' reflect the higher dollar value of earlier ripening period.

Comparing the hedgerow combination with open center trees for 'Canadian Harmony,' the hedgerow system produced more than three times the dollar value of the open center method. The difference in production is due to the difference in the number of trees per acre (518 trees per acre in the hedgerow and 99 trees per acre in the conventionally spaced open center trees).

## Other Systems

### *Fan-Palmette Hedgerow*

A fan-palmette using a central leader scaffold with two scaffolds at a 45° angle to the central leader, one on either side, oriented in the tree row is shown in Figure 6. Four trees of 'Bicentennial' were trained to this method as observational border trees. Yields were comparable to those of the replicated hedgerow trees.

### *Candelabra-Palmette Hedgerow*

Trees trained as a candelabra-palmette are shown in Figure 7. The trunk was branched at the 2 ft height. Two scaffolds were trained to the trellis wire horizontally at this height and then allowed to rebranch vertically at an interval of approximately 8 inches. Four trees of 'Bicentennial' were trained to this system as observational border trees. Yields were comparable to the replicated hedgerow trees.

### *'Y'-Shaped Hedgerow*

The senior author is shown beside a 10-year-old peach hedgerow at Byron, Georgia (Figure 8). The training system is a 'Y'-shape using 'Cornet' trees (26). This orchard had been pruned mechanically over the years and had produced crops regularly.

### *Hedgerow Mowing*

A sickle bar mower was adapted for peach hedgerow mowing (Figure 9). The height of the mower was adjustable. The sickle bar had two cutting positions, either parallel or perpendicular to the hedgerow. The mower was used for summer and dormant mowing of the canopy. Selective hand pruning was also required.

**Figure 7. 'Bicentennial' candelabra-palmette trellis-trained tree, March 1982.**

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